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Suggestions for Pre Construction Health Assessments For individuals exposed to operating wind turbines or other sources of infrasound and low frequency noise (ILFN) as at 21st September, 2012

What follows are suggestions for busy rural clinicians confronted with sick patients, and very little easily accessible information. They are based on the current limited collective knowledge about the acute and longer term consequences of exposure to operating wind turbines, and infrasound and low frequency noise (ILFN). Recent measurements of wind turbine ILFN inside and outside the homes of sick people, which are correlating with specific symptoms such as painful ear pressure and episodic sleep disturbance, have focused our attention on the existing evidence of harm from this sound energy.

It should be noted from the outset that other pathological agents which have been suggested by various researchers to be potentially implicated in some of the pathology being reported by residents living near industrial wind turbines include ground (seismic) vibration, rapid changes in barometric pressure, and electro magnetic radiation. There is limited information available about each of these in the context of wind turbines, so there has been a focus in this document on the existing evidence with respect to ILFN exposure.

The guidelines will need to be adapted according to individual clinical circumstances and presenting pathology. They have been written with the busy rural clinician in mind, hence the justifications for some of the suggestions may not be immediately obvious. The major sources of information have been listed in the Recommended Reading section, but there is also a wealth of material cited in the Waubra Foundation documents listed at the very end of the appendices. Any specific queries can be directed to me and I will try and answer as quickly as possible. Email is preferable, sarah@waubrafoundation.com.au, but if urgent, my mobile is 0439 865 914.

The information has been compiled from a variety of sources, nationally and internationally, including clinicians at the “front line” seeing these sick people, researchers, acousticians, as well as directly from the experiences of the people affected themselves. There are a limited number of relevant peer reviewed studies, which are cited through the text and in the recommended reading section, which will be of benefit to those seeking further information.

In summary, there is a wide range of reaction to exposure to operating wind turbines, from immediate severe onset of vestibular dysfunction symptoms or migraine (“wind turbine syndrome”) to no apparent response in the short term. As the duration of exposure increases more people report a range of other symptoms generally consistent with the myriad of consequences from chronic severe physiological stress and sleep

deprivation. In addition, tissue pathology and symptoms related to Vibroacoustic Disease (VAD) are also being reported, together with focal organ damage also noted in animal studies of chronic infrasound exposure.

Pre Construction History, Examination and Investigations

a. Clinical History

Useful specific features to record include:

- history of motion sickness, migraines, existing inner ear conditions; as these, together with extremes of age have been linked to increased susceptibility to developing symptoms
- documentation of past noise exposure; pre existing hearing damage, and sensitivity to noise
- documentation of past & current medical and psychiatric conditions, including particularly hypertension, ischemic heart disease, arrythmias, diabetes, thyroid disorders, inflammatory disorders, epilepsy, autism, Post Traumatic Stress Disorder (PTSD), Anxiety, Depression.

b. Examination:

- blood pressure (even in young fit people significant blood pressure elevation has been documented with exposure to wind turbines; (see also http://www.wind-watch.org/documents/an-investigation-on-the-physiological-and-psychological-effects-of-infrasound-on-persons/
- cognitive assessment (in order to detect subtle changes in cognition and memory which have been observed to occur post exposure); for example either or both those listed below:

    1. **The Montreal Cognitive Assessment Battery**: can identify mild cognitive impairment, http://www.mocatest.org/
    2. **The Trailmaking test**: a timed, simple test of spatial and divided attention http://www.granddriver.net/data/media/docs/UIowa_trailMaking.pdf

- mental health assessment questionnaires (for later comparison with repeat testing), to formally document current mental state with particular reference to validated questionnaires screening for the presence of anxiety, depression, and PTSD.
- Pittsburgh Sleep Quality Index, and Epworth Sleepiness Scale, again, for later comparison with repeat testing. Dr Daniel Shepherd's peer reviewed published study provides clear evidence of an effect on sleep quality, and sleep deprivation is the commonest symptom reported by residents living near wind turbines. Dr Shepherd's paper is available from http://www.wind-watch.org/documents/evaluating-the-impact-of-wind-turbine-noise-on-health-related-quality-of-life/

c. Baseline Pre-Exposure Investigations to be Considered:

- **baseline ECG**
  (arrythmias are commonly being reported, and heart attacks and Tako Tsubo episodes are being reported to occur in association with operating wind turbines and others exposed to infrasound and low frequency noise (ILFN) from other sources especially in quiet country environments);

- **baseline routine blood tests including kidney and liver function, complete blood picture, thyroid function including T3 and T4, fasting blood sugar and Hba1c, and cholesterol**;
  focal organ damage has been noted with chronic exposure to infrasound in animal studies (study number 58 in the following literature review : http://www.wind-watch.org/documents/infrasound-brief-review-of-toxicological-literature/ , and metabolic abnormalities of blood sugar regulation and thyroid function have been reported by a number of clinicians and have been included in Professor Robert McMurtry's proposed Case Definition (downloadable from http://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue-of-bulletin-of-science-technology-society/

- **baseline night time salivary cortisol** (for comparison with post exposure to ILFN). A number of these investigations have been done in Ontario and in the US and have shown marked differences between exposed and non exposed states, (see also section 10 of Leventhall's 2003 DEFRA review, at http://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/)

- **Baseline comprehensive hearing tests by an audiologist and review by ENT specialist** if a history of pre existing inner ear pathology has been noted. People with preexisting inner ear pathology or industrial deafness seem to be more susceptible to developing problems, and numerous residents have developed abnormalities having previously had normal hearing.

- **Baseline comprehensive visual tests**, by an optometrist and/or review by existing opthalmologist

- **Cardiac Echocardiography**, with particular attention to pericardial thickness and the state of the cardiac valves. Abnormalities of collagen (and other abnormalities) have been reported in association with long term exposure to infrasound and low frequency noise by Professor Mariana Alves Pereira, and have been given the name of VAD or Vibro Acoustic Disease. (see http://www.wind-watch.org/documents/vibroacoustic-disease-biological-effects-of-infrasound-and-low-frequency-noise-explained-by-mechanotransduction-cellular-signalling/) Recently abnormalities of mitral and triscuspid valves in German citizens exposed long term (18 years) to much smaller wind turbines have been reported to me by those residents. Concurrently, a Taiwanese research team has just shown abnormalities in echocardiographs of workers with higher ILFN doses (see http://docs.wind-watch.org/chao.html).

  Professor Alves Pereira has also documented abnormal pericardial thickness and mitral valve abnormality in a child exposed to an ILFN rich environment in utero and post conception for 10 years. (http://www.wind-watch.org/documents/public-health-and-noise-exposure/)

  Professor Pereira's presentation to the Australian National Health and Medical Research Council workshop in Canberra on June 7th, 2011 (http://www.nhmrc.gov.au/media/events/2011/wind-farms-and-human-health-scientific-forum-7-june-2011)

What Residents Can Do:

- Visit your doctor and dentist for a thorough health check prior to the turbines commencing operation.

- keep detailed personal health journals contemporaneously; both when exposed to the turbines and when away from home. Note if the turbines have been turning at the time symptoms are experienced, if known; and the more detail that can be given to locate the precise date and time of symptoms, weather and wind conditions at the time will be very useful. See the following: http://www.windturbinesyndrome.com/2012/wind-turbine-syndrome-chapmans-caution-and-personal-health-journals/?var=cna

- thoroughly record all symptoms and episodes of illness, no matter how trivial, especially infective, for all family members; and episodes of disturbed sleep;

- closely monitor growth, development, and language and cognitive development in children, with particular focus on language acquisition, mental arithmetic and memory & concentration; especially if there is any regression once turbines have commenced operating.

- also monitor mood changes, disruptive and aggressive behaviour in children; and note any changes in their behaviour and sleep patterns when at home (with turbines operating) compared to when away or when the turbines are off for more than a day.

- liase closely with school teachers, so parents may be alerted to any learning difficulties at school in a timely fashion; and ensure that teachers are aware of what abnormalities have been reported. The most detailed information comes from Dr Nina Pierpont's study, available in her book, which can be purchased at cost from www.windturbinesyndrome.com . Part of the book including the section written for health professionals and the raw case data containing details of what changes were noted in the children in the study was kindly submitted to the Australian Federal Senate Inquiry, and that submission (number 13) may be accessed via http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=clac_ctte/impact_rural_wind_farms/index.htm

- monitor blood pressures (especially with severe headaches) as markedly elevated blood pressures have been noted in many people including young adults, which have reverted completely back to normal or usual baseline when well away from operating wind turbines;

- consider a trial of antioxidants (given their reported benefit to rodents in one experiment with prolonged exposure to infrasound). These might include multivitamins. This is NOT based on peer reviewed published medical research, rather observations in one animal study looking at chronic infrasound exposure, where clear benefits to the group of rats given antioxidants were noted when compared to controls who did not receive this intervention (see study number 58 in the following weblink: http://www.wind-watch.org/documents/infrasound-brief-review-of-toxicological-literature/)

- actively try to manage stress, (eg exercise & meditation) and try and organise time away from exposure to operating turbines if needed, and able to do so; especially overnight.

- Have regular check ups with your treating doctors and dentist

- If personal financial resources permit, commission truly independent full spectrum acoustic monitoring, done by trusted acousticians who are independent of the wind industry, and keep a detailed diary of symptoms while the monitoring is being carried out. See http://www.wind-watch.org/documents/wind-turbine-acoustic-pollution-assessment-requirements/ for more detail.

Post Construction History, Examination and Investigations

As indicated by the clinical context and presenting problems, together with past medical history:

- detailed history of new symptoms with correlation of exposure to operating wind turbines, (well kept personal health journals can help greatly here, as people's short term memory is often impaired, but patterns of symptoms occurring with exposure to operating wind turbines and certain wind directions and weather conditions can be quickly identified);

- detailed health and sleep history especially correlated to turbine operation, climatic conditions, wind direction and estimate of wind speed, and time of day or night, where possible;

- Detailed health history of illnesses or symptoms when **away** from turbine exposure (eg holidays, and turbines off for maintenance);

- In North America, comparative repeat night time salivary cortisol, and more extended serum cortisol testing has been found to be markedly elevated with exposure, but returns to normal when repeated again after cessation of exposure to ILFN (when residents also report feeling "better");

- comparative repeat cognitive, sleep, and mental health questionnaire assessments as indicated – see preconstruction health check list for details.

Other investigations, which may be indicated in specific situations where specific pathology is suspected or has been identified, include:

- 24 hour blood pressure monitoring;

- sleep studies (comparing "in home" and "away from home" if possible);

- specific blood pathology indicated by the clinical picture (kidney, liver, CBP, clotting, thyroid function, blood glucose & Hba1c);

- specific radiological investigation where focal pathology is suspected, including brain MRI where indicated (eg cognitive deficits being reported, suspicion of late onset epilepsy).

- Referral if indicated to sleep, ENT, Endocrine, Cardiac, Opthalmology, Psychiatric, Psychological, Optometrist, Audiologist and other relevant health professionals.

Recommended Further Reading

Harry, Dr Amanda "Wind turbines, Noise and Health" 2007
http://www.wind-watch.org/documents/wind-turbines-noise-and-health/

Leventhall, et al 2003 Literature for DEFRA (UK Department of Food and Rural Affairs)
"Review of Published Research on Low Frequency Noise and Its Effects", especially page 49, and section 10
http://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/

Pierpont, Dr Nina "Wind Turbine Syndrome, A report on a Natural Experiment"
Published by K Selected Books, Santa Fe NM 2009
Available from www.windturbinesyndrome.com

McMurtry, Professor Robert
"Toward a Case Definition of Adverse Health Effects in the Environs of Industrial Wind Turbines: Facilitating a Clinical Diagnosis"
Bulletin of Science Technology and Society 2011 31:316
http://bst.sagepub.com/content/31/4/316
downloadable from: http://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue-of-bulletin-of-science-technology-society/

Ambrose, Stephen & Rand, Robert
"Bruce McPherson Infrasound and Low Frequency Noise Study" 2011
http://www.wind-watch.org/documents/bruce-mcpherson-infrasound-and-low-frequency-noise-study/

Frey, Barbara and Hadden, Peter
"Wind Turbines and Proximity to Homes: The Impact of Wind Turbine Noise on Health" 2012
http://www.wind-watch.org/documents/wind-turbines-and-proximity-to-homes/

Recommended websites (in addition to www.waubrafoundation.com.au)

www.windvigilance.com
The website of the Society for Wind Vigilance, the Canadian based International Group of Physicians, engineers and other professionals who are advocating for research, and who held the first International Symposium in October 2010

www.windturbinesyndrome.com
The website edited by Dr Nina Pierpont's husband, Dr Calvin Luther Martin, a retired history professor. There is a wealth of material, collected over the last 7 years, not only confined to health issues

www.wind-watch.org
A wealth of news items, videos and documents, with a very useful search function, not confined to health issues.

For further specific information, please do not hesitate to get in touch with me.
Dr Sarah Laurie, CEO Waubra Foundation sarah@waubrafoundation.com.au 0439 865 914

Appendix 1

Extract from Leventhall et al 2003 report for the UK Dept of Food and Rural Affairs on the effects of Low Frequency Noise on Human Health

"12.2 Effects on health. In an epidemiological survey of low frequency noise from plant and appliances in or near domestic buildings, the focus was on health effects (Mirowska and Mroz, 2000). …
A control group of dwellings had comparable conditions to the test group, with similar A-weighted levels, except that there was no low frequency noise. There were 27 individuals in the test group and 22 in the control group.
The test group suffered more from their noise than the control group did, particularly in terms of annoyance and sleep disturbance. They were also less happy, less confident and more inclined to depression.
The comparison of the symptoms between the tested group and the control group show clear differences, as in Table 5. "

The symptoms in this table and pattern of exposure are the same as those later described by Dr Nina Pierpont as "wind turbine syndrome". Professor Leventhall has now agreed with this publicly on numerous occasions, including while being cross examined in a court case in Ontario (see http://www.wind-watch.org/documents/audit-national-health-and-medical-research-council-public-statement-2010-and-rapid-review-2010/).

Table 5. Health comparison of exposed and control group.

Symptom	Test group %	Control group %
Chronic fatigue	59	38
Heart ailments anxiety, stitch, beating palpitation	81	54
Chronic insomnia	41	9
Repeated headaches	89	59
Repeated ear pulsation, pains in neck, backache	70	40
Frequent ear vibration, eye ball and other pressure	55	5
Shortness of breath, shallow breathing, chest trembling	58	10
Frequent irritation, nervousness, anxiety	93	59
Frustration, depression, indecision	85	19
Depression	30	5

"These results are extremely interesting as an epidemiological survey of an affected and a control group. Table 5 shows very adverse effects from low frequency noise levels which are close to the threshold and which do not exceed A-weighted limits."

Download from http://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/

Appendix 2 – Qualifications and relevant experience of Waubra Foundation CEO

DR SARAH LAURIE, CHIEF EXECUTIVE OFFICER, WAUBRA FOUNDATION

RELEVANT PROFESSIONAL QUALIFICATIONS AND EXPERIENCE

Qualifications

Bachelor of Medicine, Bachelor of Surgery awarded 1995, Flinders University, South Australia

Fellowship of Royal Australian College of General Practitioners, (RACGP) awarded July 1999

Fellowship of Australian College of Remote and Rural Medicine, (ACCRM) awarded March 2000

Clinical examiner, RACGP 2001

Member of State Council, Australian Medical Association of South Australia, 2001.

Personal

In April 2002, a sudden illness requiring immediate surgery and follow up necessitated Dr. Laurie withdrawing from practice as a rural general practitioner. It was not until 2010 that her own health and other responsibilities made it possible for Dr Laurie to consider returning to practice. During this extended period Dr Laurie did not continue to renew her registration, nor was she able to formally participate in the continuing medical education required to maintain her fellowships in RACGP and ACRRM. Regardless, Dr Laurie remains a qualified medical doctor.

In April 2010, when Dr. Laurie was preparing to re-enter the medical workforce, a wind energy project was announced for the hills near her home. A concerned neighbour drew Dr. Laurie's attention to Dr Amanda Harry's survey from 2003 (see http://www.wind-watch.org/documents/wind-turbines-noise-and-health/). This local development proposal has since been withdrawn, however Dr. Laurie's professional concern about the reported adverse health effects from exposure to operating wind turbines, and the lack of proper research continues.

In late July 2010, after voicing her growing professional concerns at a public meeting, Dr. Laurie was approached by Peter Mitchell to join the Waubra Foundation as its inaugural Medical Director, later to become its Chief Executive Officer, both roles being performed on a voluntary basis.

Experience with Wind Turbine/ILFN Health Problems

In the second half of 2010 Dr. Laurie commenced intensive fieldwork, visiting and listening to over 100 sick neighbours of wind projects and other industrial developments with noise pollution issues in South Eastern Australia, liaising with acousticians and concerned medical practitioners in Australia, Western Europe, United Kingdom, and North America.

In October 2010, Dr. Laurie attended the first International Symposium on Adverse Health Effects of Wind Turbines in Ontario, organized by the Society for Wind Vigilance (www.windvigilance.com), and ever since has liaised closely with other professionals and researchers who gave presentations at that symposium.

Dr Laurie's work has included: recommendations about setback distances for new wind projects based upon her gathering of evidence of health impacts at multiple projects; encouraging acoustic measurements by independent acousticians, assisting researchers to connect with sick residents; making submissions to relevant authorities and politicians; educating other medical practitioners; and where invited, educating concerned community groups and affected individuals.

This work has unfortunately and inappropriately attracted unpleasant comments and misleading public statements concerning Dr Laurie's professional qualifications from sections of the wind industry and its vocal, well intentioned but generally ignorant supporters, who are unwilling to accept that there is a very real problem which must be addressed, and who prefer instead to "shoot the clinical messenger".

Legal & Committee Involvement

Shortly after commencing her fieldwork, Dr. Laurie was approached to help give expert evidence in a court case in Adelaide. The academic who ultimately gave evidence for the wind developer agreed that witnesses were"sick" and they were "stressed", but then blamed that on what he called "scaremongering". Unfortunately, the court did not have the benefit of a survey conducted by Dr. David Iser from Toora, Victoria who had gathered clinical evidence of identical serious ill health from his patients living near the Toora wind project as far back as 2004, well before there was any public knowledge of these problems. In this particular case, the judges preferred the "expert" advice of the academic to field evidence from Dr Laurie.

Shortly after this, in July 2011, judges in a similar court in Ontario found that there **are** adverse health effects from wind turbines, and that further research is required. A range of international experts in acoustics and health gave evidence for both developers and the appellants. In that case, Professor Geoffrey Leventhall, one of the acousticians for the Wind Developer, admitted that he knew of the symptoms of "wind turbine syndrome" as they were identical to those occurring from exposure to low frequency noise, known to be emitted by wind turbines as well as other sources. The quote from the Canadian judgment is below:

"This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. *The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree."* (p. 207) (*Emphasis added*)

Environmental Review Tribunal, Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment, Dated this 18th day of July, 2011 by Jerry V. DeMarco, Panel Chair and Paul Muldoon, Vice-Chair,

In June 2011, Dr. Laurie was asked to Chair a Panel at the National Health and Medical Research Council's Workshop, which was re-examining the issue of adverse health effects of wind turbines. (See http://www.nhmrc.gov.au/your-health/wind-farms-and-human-health)

In July 2012 Dr. Laurie was asked by the Canadian lawyer for an upcoming case to provide independent expert witness testimony for that case. She has agreed to do so. The name of that case is Haldimand Wind Concerns V Ministry of Environment, ERT case No 12 – 073. The hearings will commence in September 2012.

Dr Laurie's own field work, and extensive knowledge of the field work of others including acoustic and psycho acoustic measurements and physiological research, is widely appreciated. Her help, knowledge and advice is sought by doctors, acousticians and researchers working in this field in Australia and overseas. Her ability to understand the acoustic and human health evidence has contributed considerably to the general community understanding of the existing known pathophysiological pathways which make this condition so devastating to a significant proportion of wind project neighbours.

Important Submissions, Letters and Documents by Dr Laurie

- Federal Senate Inquiry into the Social & Economic Impact of Rural Wind Farms, February 2011 submission number 390 at the following weblink:
  http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=clac_ctte/impact_rural_wind_farms/index.htm
  also accesssible at the following: http://www.windwatch.org/documents/submission-to-the-australian-federal-senate-inquiry-on-rural-wind-farms/

- Oral evidence given to Federal Senate Inquiry, given on 29th March 2011 http://www.wind-watch.org/documents/sarah-laurie-address-to-australian-senate-inquiry/

- Explicit Cautionary Notice 29th June, 2011
  http://waubrafoundation.com.au/~waubra/Y2NpZD0xJmNhaWQ9MTMmYWlkPSZjcmM9MTQ0OTg1MjMyOA%3D%3D

- Letter to Prime Minister Gillard 3rd March, 2012
  http://www.wind-watch.org/news/2012/03/09/letter-to-australian-prime-minister-from-dr-sarah-laurie/

- NSW Planning Department Draft Guidelines March, 2012
  http://www.wind-watch.org/documents/response-to-nsw-planning-department-draft-guidelines-for-wind-developments/

- Wind Turbine Acoustic Pollution Assessment Requirements 11th May, 2012
  http://www.wind-watch.org/documents/wind-turbine-acoustic-pollution-assessment-requirements/

- Opinion piece " Silent epidemic" 28th May 2012-08-28
  http://www.wind-watch.org/news/2012/05/31/acoustic-pollution-a-silent-epidemic/

- Submission to NSW Director General of Planning re Mt Bodangora, 8th August 2012
  http://www.wind-watch.org/documents/comments-on-wind-turbine-noise-and-its-health-effects/